

Hazardous Wide Complex tachycardia Misinterpretation!

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Abstract

Background Implantable cardioverter defibrillators trouble shooting including inappropriate shock therapy has been a problem that manufacturers and literature tackles and aim to minimize due to its psychological and physical effect on patients. In the present report we address this issue with one of our patients who received 71 inappropriate ICD shocks for SVT misinterpreted as VT.

Case report A 55 year old gentleman presented with 71 shocks delivered by his ICD. The device was implanted for tachycardia causing syncope. Device interrogation showed supra-ventricular tachycardia and inappropriate shock therapy. Invasive electrophysiological study was done with induction and ablation of AVNRT. Patient didn't receive further shocks.

Conclusion Thorough tackling of tachycardia by history and investigations is an important consideration prior to any device implantation. Device trouble shooting and complications are very important aspect to be considered in every patient. Each episode of tachycardia to be checked and analyzed. The episodes revealed in our case clearly diagnose SVT.

Key Words

Supra-ventricular tachycardia

Implantable cardioverter defibrillator

Inappropriate shocks

Presentation

A 55 year old gentleman presented to the ER with pre-syncope and severe pain in both shoulders. Patient had ICD insertion few years ago and he recalled feeling several consecutive shocks following rapid palpitations in the afternoon before heading to ER. On examination the patient was in sinus rhythm, with adequate blood pressure, the patient didn't recall losing consciousness. The patient had severe limitation of movement in both arms.

Medical history

Our gentleman had no previous relevant medical history apart from palpitations and dizziness which started in 2011 where he sought medical advice and received medication in the form of bisoprolol which was taken with relief till increasing episodes of tachycardia in October 2018 when the patient had an episode of wide complex tachycardia at 200 bpm (beats per minute) thought to be ventricular in origin. Coronary angiography was done to exclude coronary artery disease and it revealed mid LAD (left anterior descending artery) myocardial bridge. The decision was done to implant an ICD for this patient. Ever since ICD insertion patient recalled episodes of palpitations but he didn't receive any shocks. At home the patient received 71 shocks without losing consciousness and he was seen in our clinic in an emergency situation.

Differential diagnosis:

Appropriate shock versus inappropriate shock which might be due to atrial fibrillation or SVT with all its subtypes including; AVNRT, Atrioventricular reentrant tachycardia (AVRT) and atrial tachycardia.

Investigations

ICD interrogation after receiving the 71 shocks revealed episodes of supra-ventricular tachycardia with 1:1 conduction, with higher rates of tachycardia there was inappropriate shock therapy as shown in figure [1] and [2], it also showed that some episodes were 140 bpm, others were 240 bpm (lying within the ventricular fibrillation zone). Occasional PVCs were present during his tachycardia and did not influence the tachycardia. X-ray was done on both shoulders revealing dislocation in both shoulders from multiple consecutive shocks.



Figure [1]: Multiple episodes with multiple Anti-tachycardia pacing and inappropriate shocks.

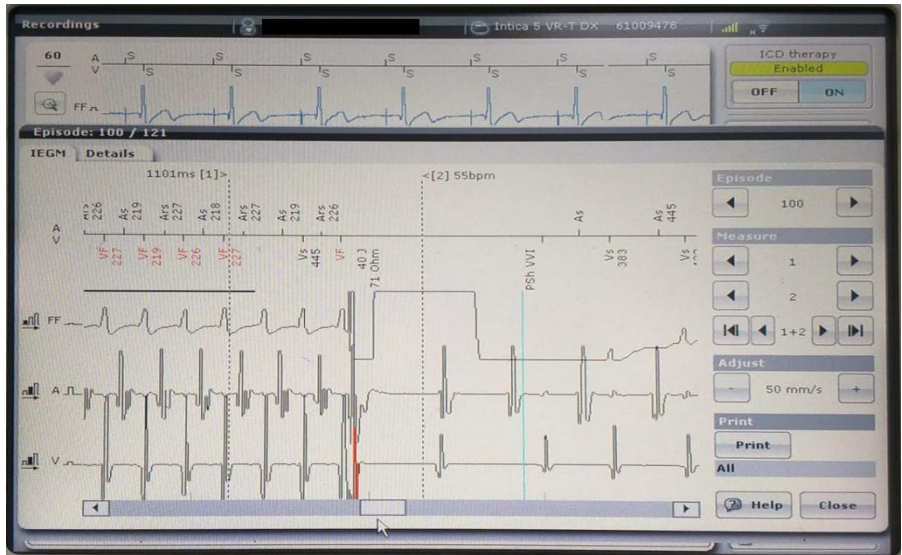


Figure [2]: Displaying Inappropriate shock therapy for SVT (short RP tachycardia), post shock junctional beat observed and patient returned to sinus rhythm.



Figure [3]: Atrial burst pacing resulting in NCT with 1:1 conduction and simultaneous activation of A and V.



Figure [4]: Ventricular overdrive pacing during tachycardia showed VAV response and post-pacing interval (PPI)-(TCL) = 135 msec which confirms the diagnosis of AVNRT. TCL = 352 ms, VOP CL = 320 ms.



Figure [5]: Post Ablation study showed absence of AH jump signifying slow pathway ablation.

Management

The patient was reassured and the anti-tachycardia pacing of the device was disabled along with shock therapy modification. An electrophysiological study was carried out and supra-ventricular tachycardia was induced by atrial burst pacing and atrial extra-stimulation where tachycardia cycle length (TCL) was 352 msec as shown in figure [3] and figure [4]. Ventricular overdrive pacing was done during the tachycardia and A-A interval accelerated with the same cycle length, post pacing interval (PPI) subtracted from TCL was 135 msec; which confirmed that this tachycardia was AVNRT. Ablation of slow pathway was done successfully, post ablation study was done atrial burst pacing and atrial extra-stimulation was done before and after atropine was given with no induction of tachycardia, neither jump nor echo beat was induced; as shown in figure [5]. The ICD was reprogrammed; ATP was disabled for VT2 zone and shock was enabled for VF zone at 240 bpm.

Follow up

The patient was followed up for 6 months and the ICD was interrogated and did not show any SVT or VT episodes.

Discussion

It is well known from literature that ICD implantation is recommended in secondary prevention of SCD and VT in patients who survived documented VF or haemodynamically not tolerated VT in absence of reversible causes [1-4]. Three trials AVID, CASH and CIDS have been conducted in patients who had suffered a cardiac arrest or life threatening ventricular arrhythmia in which treatment with ICD was compared with anti-arrhythmic drug therapy. A meta-analysis of these trials done and showed that ICD therapy was associated with 50 % reduction in arrhythmic mortality and 28% reduction in total mortality[4].

Large-scale studies have estimated the incidence of inappropriate shock in patients implanted with an ICD range from 10% to 24% [5-8]. Inappropriate shock is a response to signals generated by something other than sustained ventricular arrhythmias or hemodynamically poorly tolerated arrhythmias. Possible signals include supra-ventricular rhythms such as sinus tachycardia, AF, atrial flutter, reentrant SVT, atrial tachycardia, or instances of signal misinterpretation. Signal misinterpretation includes multiple counting of single events(e.g., atrial, T-wave or R-wave), environmental signals such as electromagnetic interference, frequent premature ventricular contractions(PVCs) and non-sustained ventricular arrhythmias, extra-cardiac physiologic signals(e.g., diaphragmatic or pectoral myopotentials), other implantable electronic devices(e.g., pacemakers, LV assist devices, nerve stimulators), inappropriate lead placement or dislodgment, conductor or insulation failures, header connection instability, and pulse generator failure [9]. The most common cause of inappropriate shocks is atrial fibrillation or atrial flutter, and several studies have demonstrated that a history of atrial fibrillation is a consistent clinical predictor of inappropriate shock [6, 7, 10]. Clinical trials and simulated testing of induced arrhythmias that compared single-vs dual-chamber discriminators have reported inconsistent results [11, 12, 13–15]. Two meta-analyses found no superiority of dual-chamber ICDs in terms of mortality or inappropriate therapies [16,17]. So attribution of increased risk of inappropriate shocks in case of single chamber versus dual chamber ICD is questionable and of controversy. In our case SVT (AVNRT) was the cause of inappropriate shocks.

Our patient was prescribed and implanted the ICD abroad after presumed VT episode with hemodynamic instability. He recalled no shocks and the early decision for us was a question mark as there were no documented tachycardia ECGs, until the patient had the episodes of inappropriate shocks and thorough analysis of the tachycardia showed that it was supraventricular tachycardia with 1:1 conduction and the patient was scheduled for an electrophysiological study where AVNRT was induced with single atrial extra-stimulation and atrial burst pacing. Radiofrequency catheter ablation of the slow pathway was successfully achieved and confirmed by post ablation study. The patient didn't experience any palpitations and had no documented episodes of tachycardia. All this raised the suspicion of faulty diagnosis of the tachycardia as ventricular tachycardia while it was probably SVT with aberrant conduction.

The implantation of an ICD is an invasive procedure if any diagnosis was doubtful an EPS is a must for justification of the decision and avoiding fallacious procedure if no documented VT episodes on ECG. As our patient suffered dislocation of both shoulders and on regular physiotherapy to restore the range of both shoulder joints motion.

Conclusion

Thorough tackling of the arrhythmia and analysis of any wide complex tachycardia should be done before tacking decision of an ICD. When in doubt EPS is a must for justification of any invasive measures and device implantation with all its complications. Device malfunction may affect the patient seriously, our gentleman still suffering from severe limitation of right shoulder movement.

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Abbreviations

AVNRT	Atrioventricular nodal reentrant tachycardia
AVRT	Atrioventricular reentrant tachycardia
EPS	Electrophysiological study
ICD	Internal Cardioverter defibrillator
PPI	Post-pacing interval
SVT	Supraventricular tachycardia
TCL	Tachycardia cycle length
VT	Ventricular tachycardia

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